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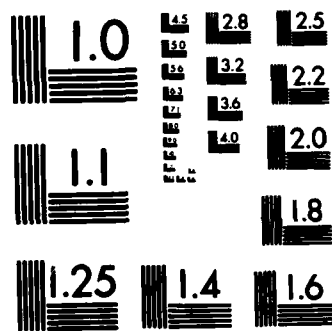
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BIRCH HILL DAM
ROYALSTON, MASSACHUSETTS

FOREST MANAGEMENT PLAN
MASTER PLAN APPENDIX B

and

FISH AND WILDLIFE MANAGEMENT PLAN
MASTER PLAN APPENDIX D

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Department of the Army
New England Division, Corps of Engineers
Operations Division
Waltham, Massachusetts

March 1981

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Birch Hill Dam	Fishes							
Forestry	Wildlife							
	Fisheries							
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) <p>The forest management portion of this plan describes the forest resources contained within Birch Hill Dam boundaries and provides a framework for managing these resources. The fish and wildlife portion describes the fish and wildlife resources of the project and serves as a guide to their management.</p>								

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NEDOD-P

SUBJECT

Master Plans Appendices B & D, Forest and Fish and Wildlife Management, Birch Hill Dam

TO	FROM	DATE	CMT 1
See Distribution	Chief, Operations Division	23 December 1981	
		Mr. Mitchell/cp/305/306	

1. The subject appendices, prepared in accordance with ER 1130-2-400, dated May 1971, has been approved by the Division Engineer.
2. The plan has been developed to increase the value of reservoir lands for recreation and wildlife, and to promote natural ecological conditions by following accepted conservation practices.
3. This plan has been developed in coordination with the Massachusetts Executive Office of Environmental Affairs and the Massachusetts Division of Fish and Wildlife.



Incl
as

V.L. ANDRELIUNAS
Chief, Operations Division

Distribution:

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- (15) Operations Division, NED
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Master Plan Appendices B and Birch Hill Dam Forest and Fish and Wildlife Management Plan

TO

FROM

DATE

CMT 1

Division Engineer

Chief, Operations Division

9 December 1981
Mr. Mitchell/cp/305/306

1. Inclosed for your approval is the Forest and Fish and Wildlife Management Plan for Birch Hill Dam. This plan will serve as Appendices B and D to the Master Plan for this project.

2. It has been prepared in conjunction with ER 1130-2-400, dated 28 May 1971. It has been reviewed by NED Planning, Engineering and Real Estate Divisions; and the Massachusetts Division of Forest and Parks; and Fish and Wildlife. Appropriate changes have been incorporated.

3. Division Engineers have been designated as approval authority for these plans by ER 1130-2-400. Information copies are to be forwarded to OCE upon approval.

Incl
as


V.L. ANDRELIUNAS
Chief, Operations Division

CF: Opers Div File

NEDDE

TO: Chief, Operations
Division


FROM: Division Engineer

DATE: 14 December 81 CMT 2

☒ APPROVED

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C.E. EDGAR, III
Colonel, Corps of Engineers
Division Engineer

BIRCH HILL DAM
ROYALSTON, MASSACHUSETTS

FOREST MANAGEMENT PLAN
MASTER PLAN APPENDIX B

and

FISH AND WILDLIFE MANAGEMENT PLAN
MASTER PLAN APPENDIX D

Department of the Army
New England Division, Corps of Engineers
Operations Division
Waltham, Massachusetts

March 1981

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Mr. Joseph Ledgere, Park Manager, LCRB

Mr. Jan Szwed - Park Ranger, LCRB

Mr. Charles Freeman - Planning Division

Mr. Don Wood - Engineering Division

Mr. Russell Keeler - Real Estate Division

Mr. John Mitchell - Operations Division

Mrs. Ann Parfenuk - Work Processing

Reprographics Section - Graphics and Reproduction

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SECTION 1. INTRODUCTION

Purpose

Birch Hill Dam is a valuable asset to the surrounding area, providing diverse recreational opportunities and preserving natural areas in public ownership as well as protecting the lakes and streams within the flood control project. The intelligent management of the lands and waters according to proper ecological practices will insure their existence and continued productivity for future generations.

The purpose of the forest management portion of this plan is to describe the forest resources contained within the project boundaries, and to provide a framework for managing these resources. The fish and wildlife portion of this plan describes the fish and wildlife resources of the project and serves as a guide to their management. This plan will enhance the value of the natural resources in the project area for recreation, aesthetics, fish and wildlife, and the provision of forest products.

Authority

This plan constitutes Appendix B (Forest Management Plan) and Appendix D (Fish and Wildlife Management Plan) to the project master plan and is authorized under ER 1130-2-400, dated 28 May 1971.

Management Objectives

The objectives of this forest and fish and wildlife management plan are to outline management practices which are compatible with flood control operations and multiple uses of project lands and waters, and the ecology of the project area. Specific objectives are to protect and enhance the natural beauty and character of the area; to provide for diversified recreational use of project resources, including nature observation and interpretation, hunting and fishing; to maintain a thrifty, vigorous forest; and, where compatible and practical, to provide wood products for project, national defense, and commercial purposes.

Coordination

This plan has been coordinated with the Massachusetts Division of Forests and Parks, the Division of Fisheries and Wildlife; and the U.S. Fish and Wildlife Service.

SECTION 2. PROJECT DESCRIPTION

Location

Birch Hill Dam is located in Royalston, Massachusetts on the Millers River about 6 miles northeast of Athol and about 28.4 river miles above the confluence of the Millers and Connecticut Rivers. The reservoir at spillway crest lies in the towns of Winchendon, Templeton, and Royalston, all in northern Worcester County. Highway access is by U.S. route 202 and Massachusetts route 68.

Acquisition

The dam was authorized by the Flood Control Act approved 22 June 1936 (Public Law No. 738, 74th Congress), as amended by Public Law No. 111, 75th Congress, approved 25 May 1937, and further amended by Public Law No. 761, 75th Congress, approved 28 June 1938. A total area of 4,394 acres has been acquired in fee and a remaining 253 acres are held in flowage easement. Total cost of the project was \$4,576,600 and was completed in February 1942.

General

The Massachusetts Department of Environmental Management is licensed to manage 4221 acres of the project for public recreation and fish and wildlife management purposes. The Division of Fisheries and Wildlife is responsible for the stocking of fish and game, wildlife habitat improvement, wildlife research and also certain facility development on approximately 4,018 acres of land at the reservoir. The Division of Forests and Parks manages approximately 203 acres that is developed for intensive recreational use around the Lake Denison Area. The lake area contains 152 camp sites, picnic and sanitary facilities and a day use area.

History

The only feature of historical significance within the Birch Hill project area is King Philip's Rock. This huge boulder overlooks the Millers River near River Road. According to local legend, Indian Chief King Philip (Metacomet) held tribal councils and met with English settlers at this location.

SECTION 3. PHYSICAL AND ECOLOGICAL CHARACTERISTICS

Topography

Most of the area is relatively flat, especially in the bottom-lands adjacent to the rivers. However, a few hills rise 100 feet or more above the flood plain. Extreme elevations are approximately 820 feet NGVD in the lower Millers River and 981 foot NGVD on a hill near Alger Road. Changes in elevation are usually gradual and present no management problems.

Climate

The climate for the area is variable with a mean annual temperature of about 46°F. The average monthly temperature ranges from 23°F in January to 72°F in July and the extremes are 90°F in July and -34°F in February. Freezing temperatures or frost may be expected between the middle of September and the middle of May. The mean annual precipitation is approximately 41 inches which is uniformly distributed throughout the year. The average monthly precipitation ranges from 2.91 inches in February to 3.87 inches in July. The extremes are 0.05 inches in March and October and 15.89 inches in September. The mean annual snowfall in the Millers River watershed is about 59 inches with over half of the amount occurring in January and February.

Geology and Soils

The soils in the project are predominantly light sandy loams that are deep, stone-free and acidic. They are easily worked with sand and gravel deposits being common.

The rock strata underlying the area is of the Partridge Formation composed mainly of mica and schist. Faults and fractures are generally parallel in a north-south configuration as is much of the drainage in the region, except for the westward flowing Millers River.

Since the glacial epoch, the mantle has been modified by weathering, erosion, and varying drainage patterns. The bedrock formations have been modified by scour and deposits of glacial outwash and debris. The young soils vary according to glacial drift and have not changed much from the parent material which have incompletely developed profiles. The slow rate of the soil-making processes is due to low summer temperatures and the length of time snow remains and the soil is frozen. There has been slight podzolization (soil stratification) in elevated sandy soils. The predominantly brown color of the soils in this area is due to the oxidation of iron and accumulation of organic material. The soils found within the Birch Hill Dam and Reservoir area are in the Hinckley, Paxton, Gloucester, and Merrimac Series. Also found within the area are muck and peat deposits consisting of well-decomposed organic matter, rough and stony land not suitable for agriculture, and meadows of overflow land with poor drainage.

Hinckley soils were deposited near the edges of the receding glacier and occur as outwash materials of kames which are characterized by a hummocky topography that occurs in scattered areas. Hinckley gravelly sandy loam has dark brown surface soils, brown subsoils, and sandy substrata with gravel that is made of rounded and outer worn fragments of quartz, granite, and gneiss. The internal drainage of this soil type can be excessive in dry seasons.

Hinckley stony loam has dark to yellowish-brown surface soil. The subsoil is gravelly sandy loam below which lies material of gray gravel, sand, and rounded boulders that are roughly assorted. A few surface granite boulders are embedded in the soil. This type is found in glacial moraines and is derived from gray granites and gneisses.

Hinckley loamy sand is yellowish-brown in color, on the surface that becomes pale deeper into the loose subsoil. There is a small quantity of gravel throughout. The substratum is composed of assorted beds of gray gravel and sand, though predominantly sand. Most material has been water laid, with some being wind blown. This soil has good internal drainage and can be droughty. It is derived from granite and other crystalline rocks.

Paxton loam occurs in drumlins with smooth, rounded or sloping surfaces, and is fairly free from stones. The soil is characterized by a dark brown surface soil, a greenish-yellow or greenish-gray heavy subsoil and substratum. It is a strong soil that will hold moisture in dry seasons and often has a hard pan layer. It is derived from deep glacial deposits of mixed materials, including schists, slate, or phyllite and granite.

Gloucester soils represent shallow, loose deposits of glacial till derived from gray granites, gneiss, and quartzite, containing rounded rocks and boulders and stony at the surface. The Gloucester sandy loam and stony sandy loam are extensively developed. Dark brown surface soils blend into yellow-brown subsoils, grading down into gray, unweathered substrata. The sandy loam has been derived from harder granites, stony loam from coarser granites, which has not been thoroughly pulverized by glacial action. Gloucester soils can tend to be droughty in prolonged dry periods.

Soil types in the Merrimac Series found in Birch Hill, loamy coarse sand and sandy loam, are derived from gray granites, gneiss, and other crystalline rocks that have been deposited on broad and level terraces, laid down as sediment by shallow moving water. The Merrimac loamy coarse sand is made up of loose and incoherent surface, yellowish-gray subsoils made up loosely of coarse sand and gravel. There is excessive drainage through the porous subsoil. The sandy loam has similar characteristics with a brown surface layer but tends to be deficient in organic material. This soil supports a forest cover of white pine, birches, some oaks, and maples.

The USDA Soil Conservation Service currently has a program underway to complete the soils mapping of Massachusetts by the early 1980s. When available, this information will help guide management efforts.

Land Classification

Aerial photographs of the Birch Hill Dam area, taken in 1975 were interpreted and used along with on-the-ground observations to classify Government-owned land according to forest type, use and other factors. The project lands have been divided into five Management Compartments for purposes of orientation and administration. Compartment locations may be seen on Map 1, (Exhibit B). Acreages are given in Exhibit A, Table 1. Forest cover types and other land classifications are delineated by compartment and are on exhibit in the basin office. Forest types were named according to guidelines from the Forest Cover Types of North America, published by the Society of American Foresters (1975).

Forest Types

Of the thirteen forest types found at Birch Hill, the most extensive is type 21, eastern white pine (Pinus strobus), covering 1862 acres. Eastern white pine is pure or occupies the dominant and co-dominant canopy positions, with red maple (Acer rubrum), the chief associate. Other subordinates are paper birch (Betula papyrifera) and black cherry (Prunus serotina). Species also found but occurring less frequently are pitch pine (Pinus rigida), spruce (Picea spp.) and tamarack (Larix laricina).

The next most extensive type is 20, eastern white pine--northern red oak--white ash, which covers 476 acres. White pine and northern red oak (Quercus rubra) are dominant trees in the canopy, while white ash (Fraxinus americana) is rarely found in Birch Hill. Red maple is the chief associate and appears along with gray birch (Betula populifolia), black cherry, eastern hemlock (Tsuga canadensis), red spruce (Picea rubens) and some planted scotch pine (Pinus sylvestris). Often this type turns into a white pine--hemlock type at a later successional stage.

The third most frequent type is gray birch--red maple (type 19) which occurs on 411 acres. This is a pioneer type on a lighter class of soils. Gray birch and red maple predominate in mixture with chief associates of quaking and bigtooth aspens (Populus tremuloides, P. grandidentata). Subordinates found in this type are black cherry, American beech (Fagus grandifolia), eastern white pine, eastern hemlock, black spruce (Picea mariana), and tamarack. The last two species are found in the wetter areas. This type is short-lived and is usually succeeded by white pine or hardwoods.

White pine--hemlock (type 22), covers 180 acres. Associates found in mixtures with eastern white pine and eastern hemlock are red maple and northern red oak. This type is usually found in small scattered areas, occasionally as a result of grazing of farm woods. A near climax type, it is probably succeeded by northern hardwoods or hemlock.

Red pine plantations (type 15) have been scattered in different dry areas, and make up 170 acres. Red pine (Pinus resinosa) is pure or in mixture with eastern white pine.

Black spruce (type 12) occurs on scattered wet areas totalling 45 acres. Black spruce is predominate with red maple as a minor associate. It is considered a subclimax type.

Hemlock (type 23) composed mostly of eastern hemlock covers 43 acres. Some associates are northern red oak, paper birch, and eastern white pine. This type is considered a climax forest, but over long periods of time may give way to sugar maple.

In Compartment 5, between route 202 and old route 202, there are 16 acres of type 38, tamarack. Tamarack is pure, growing in wet, peat soils. There is some red maple and black cherry seedlings on top of hummocks.

In Compartment 4 twelve acres of unevenaged oaks and other hardwoods are found. Since the larger trees are predominately northern red oak with some white oak, this area has been labelled type 52-6. Type 52 is the northern red oak--white oak--hickory type, but hickory (Carya spp.) is uncommon at Birch Hill. Other species found growing were gray birch and aspen.

Eight acres in Compartment 5 along side the Boston and Maine Railroad are supporting pitch pine (type 45). These trees are growing on sandy soil behind an abandoned sand pit that gets heavy off road vehicle use. Some eastern white pine and gray birch are scattered throughout the type.

Twenty-two acres are planted with scotch pine (Pinus sylvestrus). This imported European tree is poorly formed throughout the Northeast. Nearly all the trees have twisted trunks and have no sawtimber value.

The forest type with the smallest area was a 4 acre spruce stand located along an abandoned railroad right-of-way in compartment 4. This stand is a variation of type 32, red spruce (Picea rubens). Red spruce is usually found on moist or poorly drained soils that are not swamps. At Birch Hill associated species are balsam fir (Abies balsamea), eastern white pine, eastern hemlock, and tamarack, with some red maple and northern red oak regeneration.

Forest Inventory

A timber cruise was conducted during the summer of 1980 at the Birch Hill Reservoir area. Data was collected using a 10-factor prism on plots representative of the major forest types, height classes and stocking levels. Tables 2 through 5 (Exhibit A) give timber volume estimates by forest type and species by compartment, and table 6 (Exhibit A) gives the total volume of timber by species. The estimates were arrived at based on

the International 1/4-inch Rule and Gerard form class 78, with modification where appropriate based on experience. The forest stands in Compartment 3 were not cruised as they are located in the intensive recreational use areas around Lake Dennison.

SECTION 4. FOREST MANAGEMENT

Factors Influencing Forest Management

The following factors will influence the management of the forest resources at the Birch Hill Reservoir Area. These factors will need to be evaluated and considered in developing programs for forest management that will minimize adverse effects and optimize the benefits attainable from the area.

Forest Protection

Direct approaches, i.e., chemical spraying, to disease and pest problems will be used only to deal with individual trees of extremely high value or with an infestation that has attained or is likely to attain epidemic proportions.

Insects

Several insect pests occur throughout the reservoir but have not, as yet, caused serious damage. These include the white pine weevil (Pissodes strobi), saddled prominent (Heterocampa guttivitta), hemlock looper (Lambdina fiscellaria fiscellaria), fall webworm (Hyphantria cunea), tent caterpillars (Malacosoma spp.), and the gypsy moth (Porthetria dispar). The white pine weevil female burrows into the terminal shoot to lay eggs. The hatching larvae feed on the stem which kills it, and results in a crooked or multistemmed pine of reduced commercial value. Young pine growing in partial shade has a reduced incidence of infestation.

Gypsy moths are a serious pest for aesthetic reasons. However, unless trees are repeatedly defoliated over several years, healthy host trees recover. Should local communities or the State of Massachusetts plan to initiate a spray program in the area then the possibility of Corps involvement will be explored.

Diseases

Various tree diseases are present, although none are significant at this time. Entomologists or pathologists from the United States Department of Agriculture, and/or the State of Massachusetts will be asked for technical advice should a serious outbreak of disease or insect damage occur.

Air Pollution

Air pollution is not known to be a serious threat to the forest on the Birch Hill reservoir.

Soil Erosion

No areas of serious erosion were found at the Birch Hill area. An active forestry program is planned at the area and decisions on forest management activities will be guided by considering erosion potential. Skid roads and trails will be carefully planned and may be seeded to grasses or legumes after operations. The area is relatively flat with few steep slopes and erosion potential is low.

Access

Thinnings, fuelwood cutting and timber harvesting are partially dependent on the availability of suitable access for removing forest products. An adequate system of well maintained gravel roads exist at the project and skidding distance to landings along these roads will not be excessive. No major new access roads will need to be constructed at the Birch Hill Reservoir.

Boundary Maintenance

Boundary lines between monuments will be marked to make it easier for public visitors to know when they are entering or leaving federal lands, to lessen the possibility of encroachments by adjacent landowners, and to allow personnel to identify project boundaries when carrying out maintenance and resource management activities. This project has approximately 45 miles of boundary lines and a majority of the initial blazing and painting of the line between established monuments will be done by contract. Subsequent maintenance of the boundary will be performed by project personnel on a five year cycle. The Park Ranger will have primary responsibility for the periodic inspection of boundaries for timber trespass and other unauthorized uses of government land.

Flood Control Operations

Operation of Birch Hill Dam for flood control can kill standing trees by innundation. However no significant kills have occurred as storage operations have not taken place during the peak of the growing season.

Impoundment and subsequent drawdown in reservoirs may cause accumulations of woody debris at the log boom or intake gates at the dam. At Birch Hill this has not been a problem. Storage operations result in the creation of a relatively shallow impoundment covering a large area and any floated woody debris generally settles out close by its original location.

Slash, and other logging debris resulting from thinnings, harvesting, and fuelwood cutting should not increase maintenance problems at the dam.

Pesticides

It is unlikely that herbicides or insecticides will be used for forest management purposes.

Aesthetics

The natural beauty of the Birch Hill Reservoir area is very important and must be protected. All silvicultural operations carried out in forest stands will be performed so as to improve or at least impart no long term adverse influence on the aesthetics of the area. Shelterwood and individual tree selection harvesting will be preferred tree removal methods so that vegetative cover will remain.

Plantings

Natural reproduction is expected to provide for the regeneration of the various forest stands at the Birch Hill Reservoir area. Open areas currently existing will be maintained as such for wildlife habitat.

Monitoring of Forest Conditions

The general conditions and trends of forests in the reservoir area must be monitored periodically to assess the effectiveness of silvicultural treatments, to assess the need for future cultural work, and to update information on the forest resource base data. The forest should also be checked regularly for signs of developing disease and insect problems so that corrective work and salvage cuttings can be undertaken if necessary.

Management Direction

All silvicultural operations will be implemented under the direction of the LCRB Park Ranger/forester. The LCRB forester in co-ordination with the Division of Fisheries and Wildlife and the Division of Forest and Parks will specify stand prescriptions and mark trees to be cut prior to undertaking cultural work.

Forest Management Programs

General

Forest manipulation to achieve management objectives will incorporate proper silvicultural techniques including thinnings, improvement cuts, pruning and regeneration cuts where required. Timber and cordwood will be desirable by-products.

Tree harvesting is an indispensable tool of forest management. Cuttings are utilized to regulate the composition, tree distribution, productivity and environment of the forest. By their prudent use a

healthy, vigorous forest containing a variety of tree species and age classes can best be established and maintained.

Short Range Programs

Programs that should be implemented in the short-range future (1-5 years) are detailed in the following paragraphs. The silvicultural programs have long-range implications and action should be taken to derive the greatest benefits from the recommended work.

Timber Stand Improvements

Information gathered while conducting the forest inventory indicates that many forested areas in the reservoir are in need of timber stand improvements by making intermediate cuttings.

Release cuttings in young stands and improvement cuttings in older stands will be conducted to regulate the composition of species and improve the quality of the stands. Trees of undesirable species and poorly formed trees competing with better quality stems will be removed.

Thinnings will be used to reduce competition among trees for light, moisture and nutrients and to encourage the development of vegetation in the understory which is needed for wildlife food and cover requirements. Thinnings will be used to increase growth in stagnated stands, to increase growth on desired trees, and to regulate stand density. The operation usually involves the removal of poor quality trees, stands in types 15, 20, and 21 will benefit from this treatment.

Maintenance of stand vigor is important but will be subordinate to stand attractiveness in recreation developments. In the vicinity of recreation sites, cuttings will be (primarily) limited to removing hazardous, dying or diseased trees that threaten the health and beauty of the forest or the safety of its users.

Care will be taken to prevent damage to residual trees and ground vegetation. Slash may be chipped, or piled in such a manner as to provide cover for wildlife. All stumps will be cut close to the ground.

Release, improvement cuts and thinnings of hardwoods (types 16, 19 and 20) in easily accessible areas will be accomplished under a fuelwood permit program. Commercial firewood sales will be made where access is limited and heavy equipment is needed to remove the products.

People issued fuelwood permits should understand that their cutting is part of a planned timber stand improvement program. A brochure outlining management objectives and the importance of cutting only marked trees and preventing damage to seedlings and remaining trees should be provided along with the fuelwood permit.

Many stands in types 20, 21, 22, and 23 contain mature to over mature trees with good quality softwood sawlogs that will be harvested under a selection system and new growth established.

The pruning of selected white pines released during cutting operations may be accomplished if personnel are available.

Long Range Management Program

Areas should be treated to produce good quality trees of desirable species. Cuttings will stimulate regeneration of not only trees but also herbaceous plants of value for wildlife food and cover.

With proper management the entire forest could be sustained on a long term basis and yield not only cordwood and sawlogs but also improved wildlife habitat while protecting the aesthetic and recreational value of the lands at the Birch Hill Reservoir.

Any timber removal will be coordinated with project personnel, the project operations forester and with the Mass Divisions of Forest and Parks and Fisheries and Wildlife.

Disposal Plan

When commercial cutting operations are carried out and the products are determined to be surplus to project needs, a disposal plan will be prepared.

SECTION 5. AQUATIC MANAGEMENT

Existing Management

Fisheries management in the Birch Hill Reservoir Area is performed by the Massachusetts Division of Fisheries and Wildlife under a license agreement between the Division and the Corps of Engineers. Management is primarily directed toward providing a put and take trout fishery, via the stocking of trout in the Millers River, Trout Brook, Priest Brook, and Lake Denison. Species stocked include brook trout (Salvelinus fontinalis), brown trout (Salmo trutta), and rainbow trout (Salmo gairdneri). Fish are stocked throughout the spring, and in some years additional trout may be stocked in autumn depending on availability and water levels.

The numbers of fish stocked vary according to their availability from the hatchery; with fish in the 9"-12" length being the preferred stocking size. In 1979 fish were stocked at Birch Hill as follows:

<u>Location</u>	<u>Number</u>	<u>Species</u>
Millers River	1850	brook trout
	1095	brown trout
	4250	rainbow trout
Priest Brook	3000	brook trout
	1200	rainbow trout
Lake Denison	500	rainbow trout
Trout Brook	200	brook trout

Management objectives are to continue weekly stocking through April and May dependent upon water conditions. If possible, visitor counts should be made in the Birch Hill area to determine the degree of fishing pressure on stocked trout.

Lake Denison, an 85 acre natural water body, is managed as a warm water fishery by the Massachusetts Division of Fisheries and Wildlife. Gamefish present include largemouth bass,* chain pickerel and rainbow trout, (from the spring stocking). White perch, yellow perch, black crappie, bluegills, and pumpkinseeds represent the panfish fauna, while rough fish are represented by brown bullheads, yellow bullheads, golden shiners, lake chubsuckers, and white suckers.

Fish sampling and data analysis performed by personnel of the Massachusetts Division of Fisheries and Wildlife in 1980 indicates that the growth rate of largemouth bass is better than average with a 10" length reached at three years of age.

*A list of the common and scientific names of fish species found in Lake Denison may be found in Appendix A, Table 7.

Habitat for chain pickerel is plentiful. Growth for this species, as with the bass is slightly above average. Growth of yellow perch borders between poor and average, with white perch exhibiting a similar pattern. Pumpkinseeds and bluegills are growing at about the state average.

Analysis of the data gathered during the fish sampling has resulted in the following management objectives and recommendations being formulated by the Massachusetts Division of Fisheries and Wildlife.

Management Objectives:

1. Maintain the proportional stock density for largemouth bass 12" and larger to at least 40% by 1984.
2. Improve the growth rates of all panfish species to at least average for the state.
3. Obtain exploitation data on largemouth bass v'a tag returns and creel census.
4. Monitor the harvest of spring stocked trout.

Recommendations:

1. Consider raising the length limit on bass from 10.0 inches to 12.0 inches to maximize their predatory potential, particularly on panfish.
2. Encourage fishing for and keeping the catch of panfish.
3. Continue to tag as many largemouth bass as possible so that tag returns may be used as an indices of exploitation.
4. Tag a portion of the spring stocked trout so that tag returns can be used as a catch indices. Also conduct a creel census during the 120-day trout fishing period. An artificial impoundment containing 50 acres and known as Beaver Pond also provides fair to good fishing for largemouth bass.

Law Enforcement

Natural Resource Officers of the Massachusetts Division of Law Enforcement are responsible for enforcing the fish and game laws at the Birch Hill Reservoir. Corps of Engineer employees as well as employees of the Division of Forest and Parks and the Division of Fisheries and Wildlife are expected to notify personnel from the Division of Law Enforcement should they observe any violations of the law.

Water Quality

The Millers River and the Otter River have been designated as Class "B" waters according to the criteria of the State of Massachusetts. Class "B" waters are considered excellent for fish and wildlife habitat.

The Corps of Engineers Water Quality Laboratory collects and analyzes water samples from the project as part of the water quality management program. The Massachusetts Division of Fisheries and Wildlife measures

water parameters prior to trout stocking to insure adequate fish survival and highest fishing success.

Access and Fishing Pressure

Access for fishing in the various brooks and the Millers River within the project area is considered good to excellent. The area is accessible by vehicles on approximately 28 miles of gravel roads and old logging roads, and 3 miles of paved road. Parking is available at numerous roadside clearings. A gravel boat ramp and parking area on Lake Denison provides excellent access for boat fishermen. Although no detailed counts have been made for several years, fishing pressure is considered heavy, especially in the spring during the stocking season. Map 2 Exhibit B shows principle fishing access areas.

Estimated annual attendance for fishing in the Birch Hill area averages between 46,000 and 50,000. Future visitor counts and tag return programs by the Massachusetts Division of Fisheries and Wildlife are recommended to more accurately determine angler utilization and angler success rates on the stocked trout and largemouth bass in the project area.

Pesticides

The use of pesticides in the Birch Hill project area is limited to herbicides. Herbicides are used by the Corps of Engineers to control undesirable plant growth on the rock faces of the dam; the Massachusetts Electric Company, to control vegetation under their power lines and by the Boston and Maine Railroad on their railroad bed.

No negative effects on aquatic species have been reported following the spraying of herbicides for these purposes. Herbicides will continue to be used to control undesirable vegetation and the impact of applications will be monitored. Federal and State regulations will be followed while pesticide applications are taking place.

Commercial Fishing

The lack of a suitable commercial fish species and the intensively used sport fishery precludes commercial fishing in the Birch Hill Reservoir area.

Reservoir Clearing

Birch Hill is a drybed reservoir and little clearing of wooded areas took place during construction. Open areas at the reservoir are the result of either their being cleared for wildlife habitat improvements or were fields existing at the time of purchase and maintained as such.

Aquatic Weeds

No areas of aquatic weed growth occur on the project area that would have an injurious effect on the fishery or on angler opportunity.

Endangered Species

No rare or endangered species are known to exist in the Birch Hill Reservoir area. Generally rare species are associated with rare habitat types or have exacting requirements with respect to a host of environmental factors. The habitat in the reservoir is common in the surrounding general area.

Short and Long Range Management

The Massachusetts Division of Fisheries and Wildlife is doing an excellent job of providing visitors to the Birch Hill Reservoir area with good quality fishing opportunities. The stocking program should be continued as at present and reassessed when angler counts, creel census information and tag return data are gathered and analyzed by personnel from the Division.

SECTION 6. WILDLIFE MANAGEMENT

Existing Management

Since 1952, the Massachusetts Division of Fisheries and Wildlife has managed 4,018 acres of land at the Birch Hill Dam-currently licensed to the Massachusetts Department of Environmental Management-by the Corps of Engineers. This land and an additional 4,000 acres of State owned property adjacent to the Federal land is operated as the Birch Hill Wildlife Management Area. It is one of the largest and most heavily used Wildlife Management areas in the State.

Objectives of the Division of Fisheries and Wildlife

The primary objective is to provide good quality hunting, fishing and trapping for as large a number of persons that is obtainable. Such recreational enjoyment must remain within the bounds of good safety conditions and must follow sound conservation practices that encourages utilization of resources while, at the same time, protecting them from destruction and waste.

The secondary objective is to encourage and provide for other forms of recreation and uses of a non-consumptive nature that are compatible with primary objectives. Non-consumptive compatible uses include bird and nature study, natural history and ecological education, hiking, field dog trials, target practice, horseback riding, photography, etc.

Land Use Effect on Vegetative Cover

At the time of purchase, over 90 percent of the land was forested with a few scattered clearings which had been planted to hay or corn in connection with local dairy farming. Many of the forest stands were managed for the production of pulp and other wood products. In most of the area, therefore, selective and clear cutting of merchantable timber has occurred. Mature and sub-mature stands of white pine and red pine from both natural seeding and reforestation plantings are now common throughout. Hemlock and mixed second-growth hardwoods are also abundant.

Most clearings were being invaded by pioneer tree and shrub species at the time of initial wildlife management. Pitch pine, gray birch, sweet fern and poverty grass were dominant with lesser invasions of aspen and white pine.

Management efforts basically have followed two routes: maintenance of existing fields and openings; and creation of new clearings. Since management began, approximately 281 acres of clearings have come under regular maintenance. Of this total, about 221 acres have been developed from brushland or forested areas. Wherever possible, clearing of forested land has been limited to pole-stage hardwoods and areas having little or no value for timber. Approximately 20 percent has consisted of dense, even aged stands of white pine and hemlock from which merchantable lumber

has been salvaged, mostly by selective thinning. In recent years, harvesting has averaged about 10,000 board feet per year. This resource has been utilized by the Division for signs, wood duck nesting boxes, posts and construction material for use at Birch Hill, game farms, fish hatcheries and other wildlife management areas. The primary purpose for land clearing has always been that of habitat improvement to benefit wildlife.

Following initial clearing, fields typically have been prepared and planted to annual crops of rye, corn, millet, or buckwheat. Subsequent plantings have usually been of perennials such as reed canary grass or a hay mix of reed canary, clovers, timothy and other grasses. Top dressing with fertilizer and lime has been carried out regularly on existing fields.

Trees and shrubs have been planted along open edges as field dividers and in groupings to provide islands of cover in large fields. Planting was done from 1953 to 1963. Coniferous plantings include over 5,000 white pine, 7,000 red pine, 400 Austrian pine, 1,000 balsam fir, and 1,300 Norway spruce. Survival has been fair to good and management objectives have generally been met. Other plantings include 20,700 multiflora rose and several experimental plantings of stocks from the U.S. Soil Conservation Service consisting of: several species of crabapple, Chinese chestnut, sumac, American larch, autumn olive, tartarian honeysuckle, and silky dogwood. Survival of larch has been good. Except for tartarian honeysuckle and multiflora rose, survival of others has been poor.

Species Management

The following paragraphs discuss the status of major species and the management practiced by the Division for each species. They have been adapted from Mugford, Burrell, and Neale (1971).

Resident Game Species

Ruffed grouse (Bonasa umbellus): The population is good. Extensive forested areas that are relatively inaccessible serve to keep the hunting pressure low. Ample food and cover exists throughout the area to meet habitat requirements. Management includes creation and maintenance of openings and development of uneven-aged stands of trees through selective cutting.

Ring-necked pheasant (Phasianus colchicus): The population is poor. A few nesting birds are occasionally found. Intensive hunting pressure on the limited open land virtually assures a heavy harvest of native birds. Habitat improvements serve to concentrate birds on areas best suited to their needs. Annual grains are planted in scattered blocks. Most fields are in perennial grasses. These meet most of the food and cover requirements of native and stocked pheasants. Future management efforts will concentrate on improving cover and hunting conditions for the "put-and-take" type of program.

Production of native birds will continue to be looked upon as an unexpected bonus.

Cottontail rabbit (Sylvilagus floridanus): The population is good in some areas. The best populations occur in brushy or swampy sites and along forest edges and clearings. Management efforts center on the creation of more "edge", grassy clearings, and opening of overhead forest canopies to encourage ground cover development and shrubby growth.

Varying hare (Lepus americanus virginianus): The population is excellent. Much of the habitat approaches the ideal, and with anticipated preservation of existing cover, there is little reason to expect abnormal decline in population level. Management effort is minimal and limited to the protection of existing habitat.

Gray squirrel (Sciurus carolinensis pennsylvanicus): The population is poor. A scarcity of large mast producing trees is evident. No management is practiced nor is any contemplated.

Whitetail deer (Odocoileus virginianus): The population is fair. Management practices include logging by selective and clear-cut methods, brushcutting of open areas and roadsides, planting of annual and perennial grasses and grains and building of waterholes. Similar practices are planned for the future.

Raccoon (Procyon lotor): The population is good. No intentional management for this species is practiced.

Furbearers

Beaver (Castor canadensis) and muskrat (Ondatra zibethicus) populations are good. Mink (Musela vision) and otter (Lutra C. Canadensis) populations are fair. Existing streams and ponds plus the impoundments and pot holes provide good habitat. The management area was used as a release site for nuisance beaver taken elsewhere, but this practice has been discontinued. Trapping pressure is heavy and harvest is good. Present management practices will be continued.

Migratory Game Species

Woodcock (Philohela minor): The population is good. Wetlands on the area are fairly abundant. No specific management for this species is practiced nor is any contemplated.

Waterfowl: The population is fair. The black duck (Anas rubripes) is the most common with lesser numbers of wood duck (Aix sponsa) mallard (Anas platyrhynchos platyrhynchos) and an occasional Canada goose (Branta canadensis). Some effort has been made to establish a breeding flock of Canada geese. Results have been poor. Waterfowl have been attracted to the two artificial impoundments and the small waterhole. Future

management efforts may include creation of other small impoundments or pot holes as well as nesting box or nesting habitat construction and development.

Non-game Species

Mourning dove (Zenaida macroura): The population is poor. Some improvement may have occurred incidental to the clear-cutting which established new fields, but it has not been significant. Further opening of unsuitable forest types and additional plantings of grasses and grains may contribute to improving the population.

Woodchuck (Marmota monax): The population is good. Some hunting occurs for this species, but no management will be undertaken specifically for the benefit of this species.

Predators

Red fox (Vulpes fulva): The population is good. The condition and magnitude of existing habitat should maintain the present population level. No predator control practices are employed or contemplated.

Gray fox (Urocyon cinereoargenteus): The population is good. Limited habitat changes assure maintenance of present population. No predator control is practiced or contemplated.

Bobcat (Felis rufus rufus): The population is limited. A few have been occasionally observed in the area. No specific management for this species is planned.

Stocked Species

Ring-necked pheasant: A minimum of 2,000 pheasants are stocked annually under a "put-and-take" program made necessary by a paucity of naturally produced birds. Stocking is deliberately practiced "close to the gun" to provide maximum harvests during the open season. Occasional surplus hens are stocked as available. Slight production in recent years has resulted from hen stocking.

Varying hare: Approximately 20-30 hare are released annually to supplement the natural population.

Wetlands

Birch Hill has extensive wetland areas in the forms of marshes, wooded and shrub swamps, and other riparian zones. These areas provide food and cover for many water birds, amphibians, reptiles and furbearing mammals. These wetlands are very sensitive to human activities and their remaining in public ownership will ensure their protection.

Forest Management Effects on Wildlife

Forest management affects wildlife populations through changes in habitat. In general, timber stand improvements may result in increased production of wildlife through enhanced habitat for the species that can take advantage of the new herbaceous and woody growth.

The closed canopy of much of the forest excludes ground cover or understory plants which many wildlife species depend on for food and cover. The timber stand improvements to be carried out under the forest management section of the plan, in addition to the limited cuttings carried out by the Division of Fisheries and Wildlife, will result in the creation of several diverse forest types, numerous tree age classes, various sunlit openings with their accompanying "edges", and hopefully a variety of understory vegetation. The preservation of den and nest trees, and other favorable breeding and nesting places, the maintenance of natural wildlife food species and the increase in the diversity of the forest should result in increased production of both game and nongame wildlife species.

Law Enforcement - Fish and Game

Natural Resource Officers of the Massachusetts Division of Law Enforcement are primarily responsible for enforcing the fish and game laws on the Birch Hill Wildlife Management Area. Division of Fisheries and Wildlife personnel also patrol the area on a regular basis, especially during the hunting season. Corps of Engineers employees are expected to notify personnel of the aforementioned Divisions should they observe any violations of the law.

In addition to the fish and game laws of the Commonwealth of Massachusetts, the Division of Fisheries and Wildlife has established rules and regulations pertaining to Wildlife Management Areas. These regulations are posted at a large number of locations within the Birch Hill Wildlife Management Area.

Adequacy of Lands for Wildlife

Management of fee owned lands appears to be sufficient to maintain, improve and protect Birch Hill's wildlife populations. Designated wildlife management areas are shown on Map 2, Exhibit B.

Hunter Access and Designation of Hunting Areas

Hunter access to the project is ample and is provided by the many roads and trails into and through the area. The entire project area is open to hunting with the exception of the recreational facilities near Lake Denison and those areas within 150 feet of a hardsurface road and 500 feet from dwellings or buildings as per Massachusetts fish and game laws. Personnel from the Division of Fisheries and Wildlife have placed "Safety Zone" signs in areas where discharging a gun is prohibited.

A rifle range, used on a permit basis, is located on the Wildlife Management Area and is maintained by the Division of Fisheries and Wildlife.

Wildlife Observation

Beyond the economic and sporting value of numerous wildlife species, Birch Hill fauna have an aesthetic value for those interested in wildlife observation. Mammals and birds residing on the fringes of picnic and campground areas and in open areas along the roadsides and dam are perhaps the more noticeable resident creatures. Visitation by sightseers will be enhanced by good cultural practices aimed at creating adequate food and cover conditions for wildlife near these sites. A checklist of birds recorded for the Birch Hill Wildlife Management Area may be found in Table 9, Appendix A.

Rare, Endangered, and Unique Species

Generally, rare species are associated with rare habitat types or have exacting requirements with respect to a host of environmental factors. Although no rare or endangered species were found and the habitat represented at Birch Hill Dam is not uncommon in the general area, it is possible that species of special concern do exist on the project. Before any of the more intensive forest management activities are carried out, the operating areas should be examined for the presence of rare species. As information is developed, areas should be mapped to guide future management efforts.

SECTION 7. SPECIAL NEEDS

Information and Education

Information and education are important aspects of the forest, fish and wildlife management program. It is imperative that the public be informed of management decisions and programs. Efforts will be made to publicize programs and actions, such as timber cuts.

Education efforts will be directed at explaining the purposes behind management and broadening the general public's understanding of ecological relationships.

The image and understanding of the Corps recreation - resource management program can only be enhanced by public contacts initiated through an organized public relations program.

Current information and education efforts concerning the forests, fish and wildlife at Birch Hill Dam will be expanded to include attractive brochures that are educational, informative, and specific to the property. The Division of Fisheries and Wildlife will be consulted with on brochure preparation.

Interpretive Programs

The possibility of presenting interpretive programs at the Lake Denison Camping Area will be discussed with personnel from the Massachusetts Department of Environmental Management. Topics could include, resource management at the Birch Hill Wildlife Management Area, and the operation and role of Birch Hill Dam for flood protection.

SECTION 8. FIVE YEAR WORK PLAN

General

The management programs of the Massachusetts Division of Fisheries and Wildlife should continue to be implemented as funding and manpower availability permit.

As specified under the terms of the license agreement between the Corps of Engineers and the Department of Environmental Management, annual work plans should be submitted to the Corps prior to the beginning of the year in which the work is to be accomplished.

Forest Management activities to be carried out by the Corps of Engineers after co-ordination with the Division of Forests and Parks and Fisheries and Wildlife are tentatively scheduled as follows:

Years 1 & 2: - Begin Improvement cuts in hardwood forest types under a fuelwood permit program and/or commercial firewood sales.

1 - Begin Commercial thinnings in types 15, 20 and 21.

Years 3 - 5: - Begin commercial selection cuttings in types 20, 21, 22 and 23.

1 - Begin pruning of selected white pines released or thinned during years 1 and 2 as personnel and funding is available.

SECTION 9. PERSONNEL AND FUNDING REQUIREMENTS

The implementation of this management plan will require as a minimum the personnel and funding requirements described below.

Forest Management

Personnel:

1-GS-9 Park Ranger for 50 days = \$4,000. Plan and administer contracts for removal of forest products, revision of plan, administer boundary marking contracts, coordinate programs with State.

1-GS-4 Forest Technician for 50 days = \$2,000. Assist ranger to examine stands for thinning needs, mark and tally trees for removal. Monitor fuelwood cutting program.

Equipment:

1/4 by 2 P/U truck for transportation.

\$30.00/day for 50 days = \$1,500. Every year.

Fish and Wildlife Management - Massachusetts Division of Fisheries and Wildlife.

Approximately \$85,000/year for salaries, supplies and materials and stocking of fish and game.

REFERENCES

Society of American Foresters. 1975. Forest Cover Types of North America. Bethesda, Md. 67 pp.

Mugford, Paul S., R.G. Burrell, and W. Neale. 1971. Birch Hill Wildlife Management Area Plan. Unpublished report, Bureau of Wildlife Research and Management, Massachusetts Division of Fisheries and Game.

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1. Land Classification and Forest Types (Acres)
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TABLE 1.

Land Classification and Forest Types
(Acres)

	Compartments					Total
	1	2	3	4	5	
Project Operation	7	3	21	71	22	124
Wetland	64	73	9	127	207	480
Sand/Gravel	19	2	3	11	1	36
Water	32	8	83	78	44	245
Open Fields	59	20	3	108	122	312
Power Line	-	7	-	22	-	29
Forest	976	207	128	1114	743	3168
Totals	1157	320	247	1531	1139	4394
Forest Types						
Black Spruce						
12-2-A	3	-	-	22	-	25
12-3-A	20	-	-	-	-	20
Red Pine						
15-3-A	38	3	-	39	90	170
Aspen						
16-1-A	4	-	-	-	-	4
16-2-A	4	-	-	36	-	40
16-2-B	24	-	-	4	1	29
16-3A	-	-	-	13	-	13
Grey Birch-Red Maple						
19-1-A	2	-	-	21	-	23
19-1-B	-	3	-	-	-	3
19-1-C	-	-	-	13	-	13
19-2-A	16	3	-	67	27	113
19-2-B	9	-	-	9	38	56
19-2-C	8	-	-	-	-	8
19-3-A	13	5	-	101	41	160
19-3-B	-	-	-	-	4	4
19-6	4	10	-	9	8	31
White Pine-N.Red Oak-W.Ash						
20-2-A	-	-	-	11	3	14
20-3-A	56	16	34	57	249	412
20-3-B	18	-	-	-	8	26
20-4-A	-	-	-	-	24	24
White Pine						
21-2-A	1	9	-	5	10	25
21-2-B	3	3	-	16	-	22
21-3-A	634	145	94	616	92	1581
21-3-B	2	-	-	8	34	44
21-3-C	9	-	-	3	-	12
21-4-A	-	2	-	-	-	2
21-6	-	-	-	8	-	8

TABLE 1. (Cont'd)

White Pine-Hemlock						
22-3-A	65	-	-	27	88	180
Hemlock						
23-3-A	43	-	-	-	-	43
Red Spruce						
32-3-A	-	-	-	4	-	4
Tamarack						
38-3-A	-	-	-	-	16	16
Pitch Pine						
45-2-A	-	-	-	1	-	1
45-3-B	-	-	-	-	8	8
White Oak-Red Oak-Hickory						
52-6-A	-	-	-	12	-	12
Scotch Pine		8	-	12	2	22
Totals	976	207	128	1114	743	3168

TABLE 2.

COMPARTMENT 1

Timber Volume Estimate For Individual Species And
Forest Cover Types

<u>Forest Type</u>	<u>Acres</u>	<u>Black Spruce</u>	<u>White Pine</u>	<u>Red Pine</u>	<u>Red Maple</u>	<u>Hemlock</u>	<u>Red Oak</u>
BOARD FEET INTERNATIONAL 1/4 INCH RULE							
12-2-A	3	1140					
12-3-A	20	20000					
15-3-A	38		74100	342000			
19-2-A	16		4480				
19-3-A	13		9490		18070		
20-3-A	56		179200		2240	28560	21840
20-3-B	18		45000				
21-2-A	1		840				
21-3-A	634		4805720				
21-3-B	2		11900				
21-3-C	9		19890				
22-3-A	65		324350			221650	
23-3-A	43		28380		17200	235210	15480
TOTALS	918	21140	5503350	342000	37510	485420	37320

TABLE 3.

COMPARTMENT 2

Timber Volume Estimate For Individual Species And
Forest Cover Types

<u>Forest Type</u>	<u>Acres</u>	<u>White Pine</u>	<u>Red Pine</u>	<u>Red Maple</u>	<u>Hemlock</u>	<u>Red Oak</u>	<u>Scotch Pine</u>
BOARD FEET INTERNATIONAL 1/4 INCH RULE							
15-3-A	3	5850	27000				
19-2-A	3	840					
19-3-A	5	3650		6950			
20-3-A	16	51200		640	8160	6240	
21-2-A	9	7560					
21-3-A	145	1754500					
21-4-A	2	24200					
Scotch Pine	8						12720
TOTALS	191	1847800	27000	7590	8160	6240	12720

TABLE 4.

COMPARTMENT 3

Timber Volume Estimate For Individual Species And
Forest Cover Types

<u>Forest Type</u>	<u>Acres</u>	<u>Black Spruce</u>	<u>White Pine</u>	<u>Red Pine</u>	<u>Red Maple</u>	<u>Hemlock</u>	<u>Red Oak</u>	<u>White Oak</u>	<u>Scotch Pine</u>
BOARD FEET INTERNATIONAL 1/4 INCH RULE									
12-2-A	22	8360							
15-3-A	39		76050	351000					
19-2-A	67		18760						
19-3-A	101		73730		140390				
20-2-A	11		17050				4070		
20-3-A	57		182400		2280	29070	22230		
21-2-A	5		4200						
21-3-A	616		1232000						
21-3-B	8		13600						
21-3-C	3		4200						
22-3-A	27		54000			92070			
32-3-A	4	10160	4000			1840			
52-6-A	12		3240				13140	9840	
Scotch Pine	12								19080
TOTALS	984	18520	1683230	351000	142670	122980	39440	9840	19080

TABLE 5.

COMPARTMENT 5

Timber Volume Estimate For Individual Species And
Forest Cover Types

<u>Forest Type</u>	<u>Acres</u>	<u>White Pine</u>	<u>Red Pine</u>	<u>Red Maple</u>	<u>Hemlock</u>	<u>Red Oak</u>	<u>Pitch Pine</u>	<u>Scotch Pine</u>
BOARD FEET INTERNATIONAL 1/4 INCH RULE								
15-3-A	90	175500	810000					
19-2-A	27	7560						
19-3-A	41	29930		56990				
20-2-A	3	4650				1110		
20-3-A	249	76800		9960	126990	97110		
20-3-B	8	20000						
22-3-A	88	439120			300080			
45-3-B	8	8960					3440	
Scotch Pine	2							3180
20-4-A	24	124800				91200		
TOTALS	540	887320	810000	66950	427070	189420	3440	3180

TABLE 6.

GRAND TOTAL SUMMARY SHEET

Timber Volume Estimate For Individual Species And
Forest Cover Types

Forest Type	Acres	White Pine	Red Pine	Black Spruce	Red Maple	Hemlock	Red Oak	White Oak	Scotch Pine	Pitch Pine
BOARD FEET INTERNATIONAL 1/4 INCH RULE										
12-2-A	25			9500						
12-3-A	20			20000						
15-3-A	170	331500	1530000							
19-2-A	113	31640								
19-3-A	160	116800			222400					
20-2-A	14	21700								
20-3-A	412	489600			15120	192780	5180 14720			
20-3-B	26	65000								
20-4-A	24	124800				91200				
21-2-A	25	12600								
21-3-A	1581	7792220								
21-3-B	44	25500								
21-3-C	12	24090								
22-3-A	180	817470								
23-3-A	43	28380			17200	613800 235210 1840	15480			
32-3-A	4	4000		10160						
45-3-B	8	8960								3440
52-6-A	12	3240						9840		
Scotch Pine-3-A	22								34980	
TOTALS	2895	9897500	1530000	39660	254720	1134830	186400	9840	34980	3440

TABLE 7.

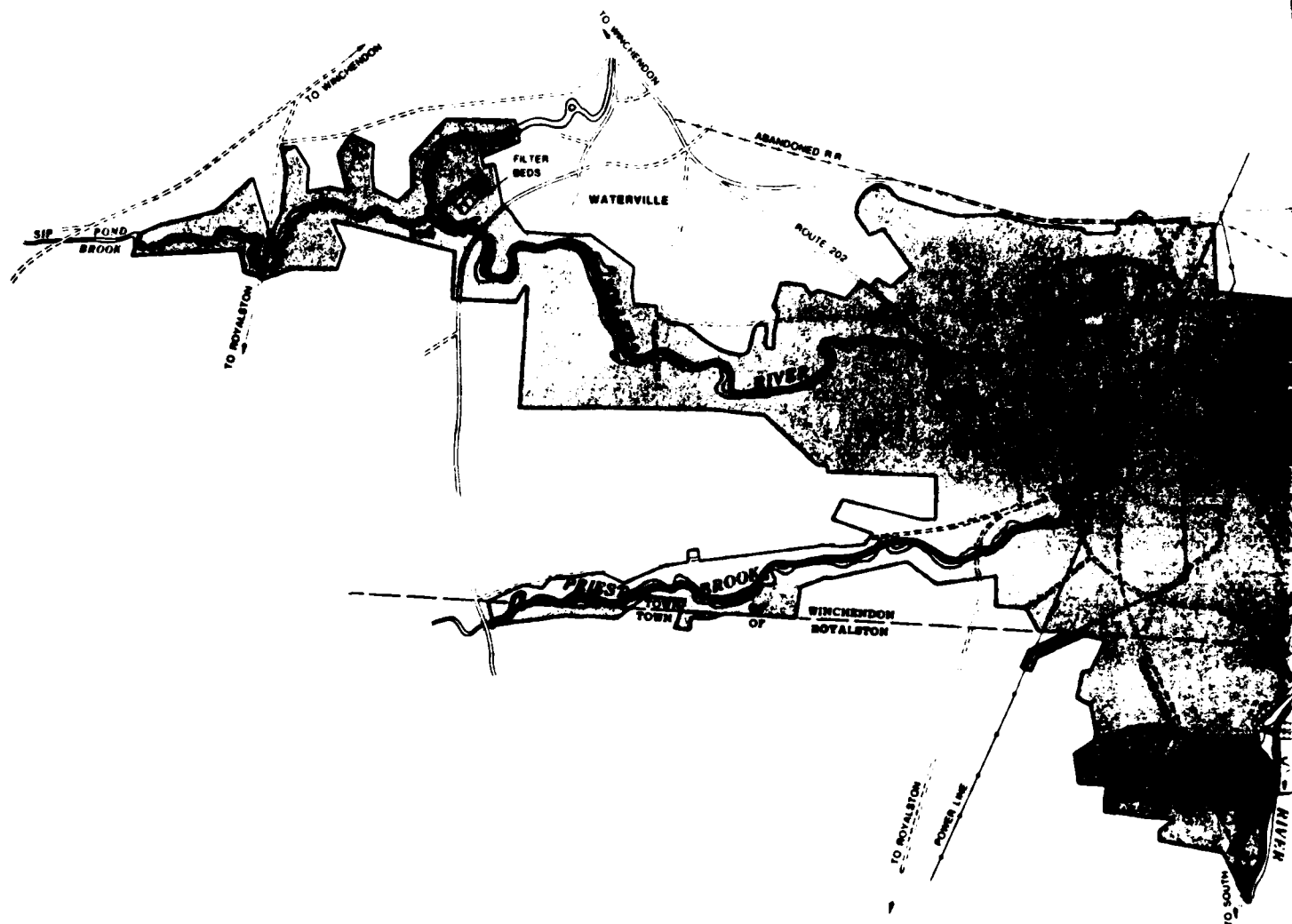
Species of Fish Found in Lake Denison

Largemouth bass	<u>Micropterus salmoides</u>
Chain Pickeral	<u>Esox niger</u>
Yellow Perch	<u>Perca flavescens</u>
White perch	<u>Morone americana</u>
Black crappie	<u>Pomoxis nigromaculatus</u>
Bluegill	<u>Lepomis macrochirus</u>
Pumkinseed	<u>Lepomis gibbosus</u>
Brown bullhead	<u>Ictalurus nebulosus</u>
Yellow bullhead	<u>Ictalurus natalis</u>
White sucker	<u>Catostomus commersoni</u>
Golden shiner	<u>Notemigonus crysoleucas</u>
Lake chubsucker	<u>Erimyzon oblongus</u>
Tessellated darter	<u>Etheostoma fusiforme</u>

EXHIBITS

MAPS OF BIRCH HILL

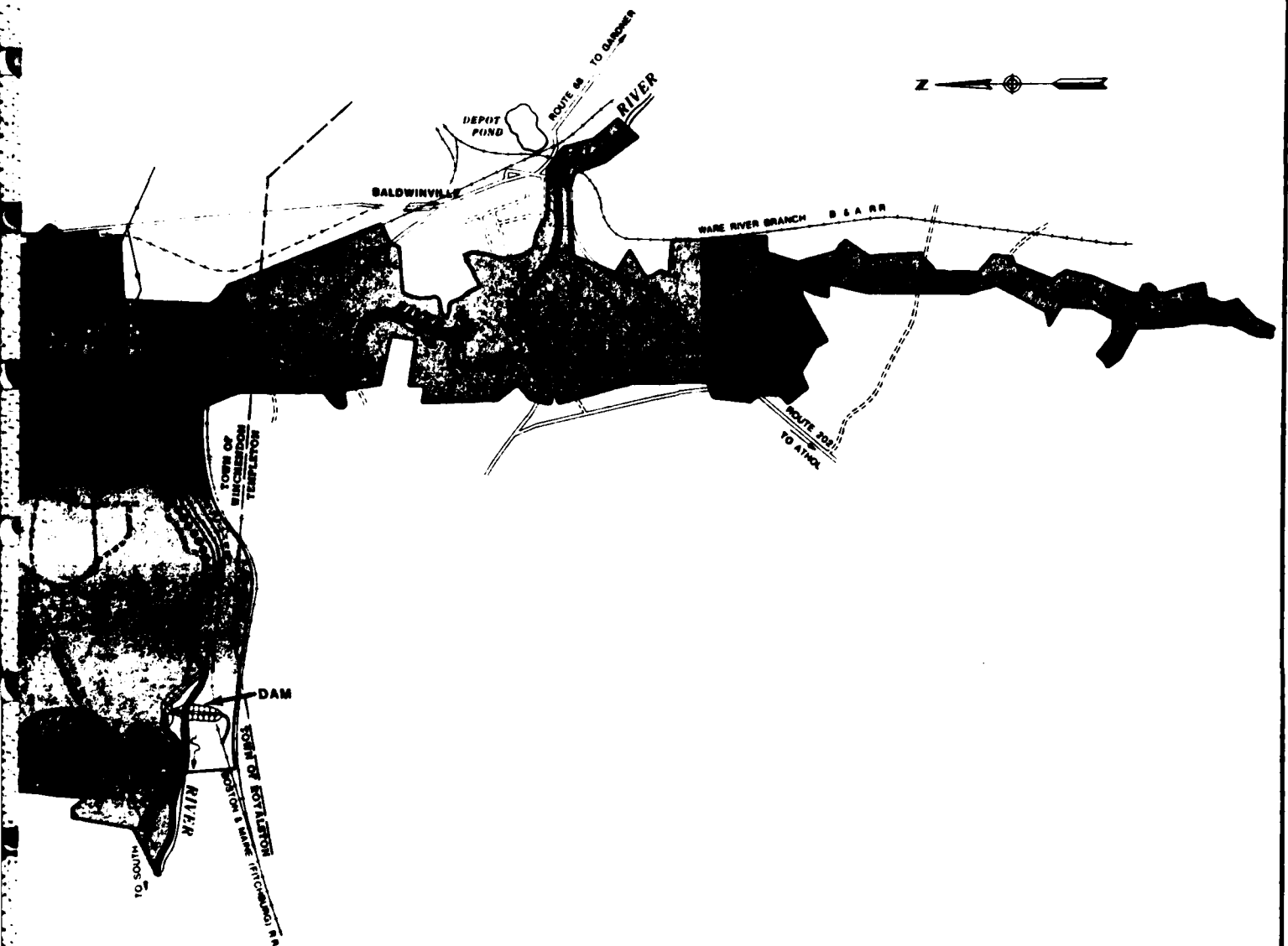
1. **Forest Compartment Map**
2. **Fish and Wildlife Management Areas**



SYMBOLS

- Wildlife Management Areas
- ★ Boat Ramp
- Foot Access
- Car and Foot
- ▨ Beaver Flowage

WILDLIFE MANA
RECREATION A
BIRCH HILL
 1400 0 1400



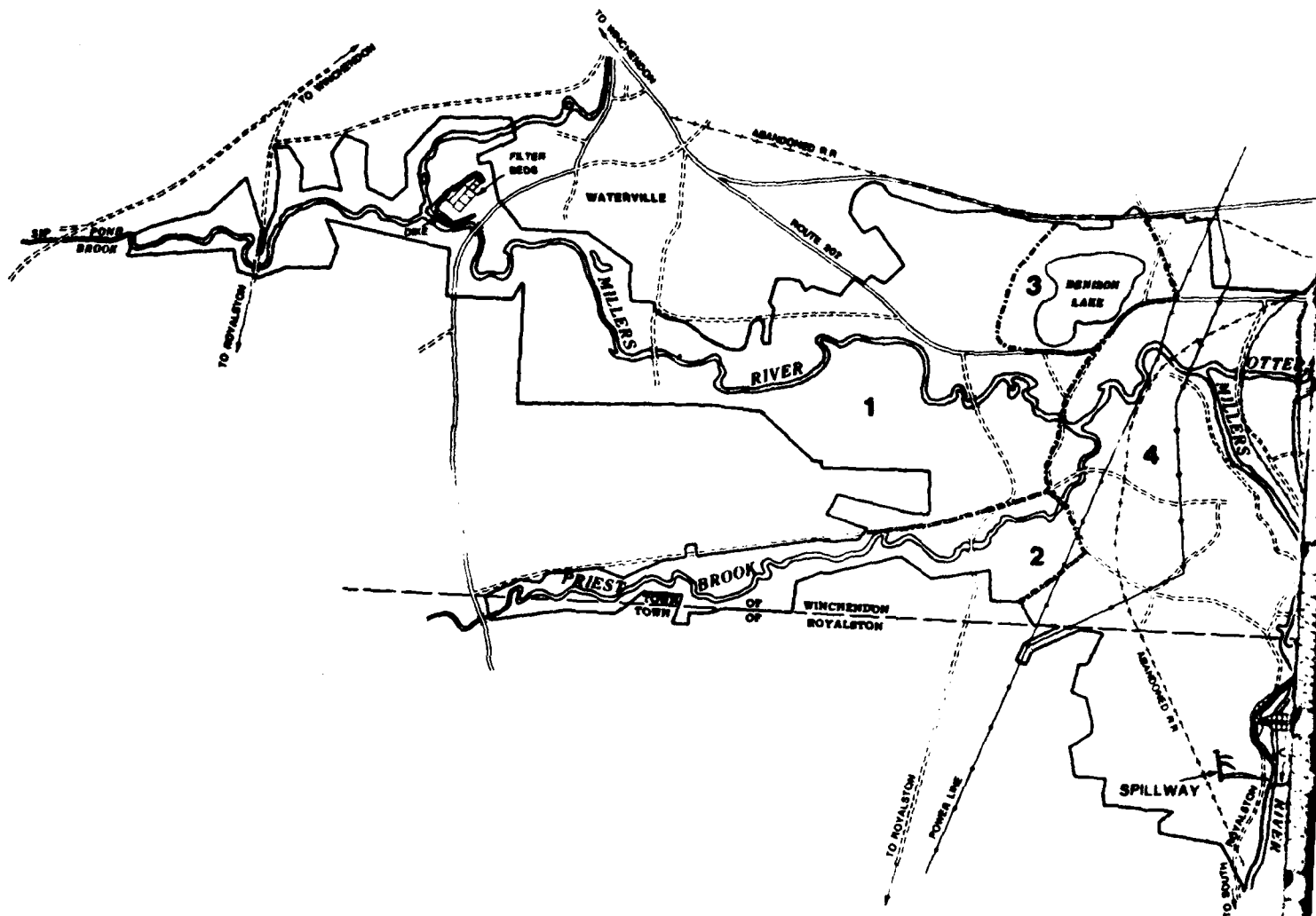
LEGEND

- ==== Paved Road
- Gravel Road
- - - - - Compartment Boundary
- ===== Outline of C.E. Property
- ===== Town Line
- ~~~~~ Water
- ~~~~~ Dam, Dikes

**WILDLIFE MANAGEMENT-
RECREATION AREAS OF
BIRCH HILL DAM**

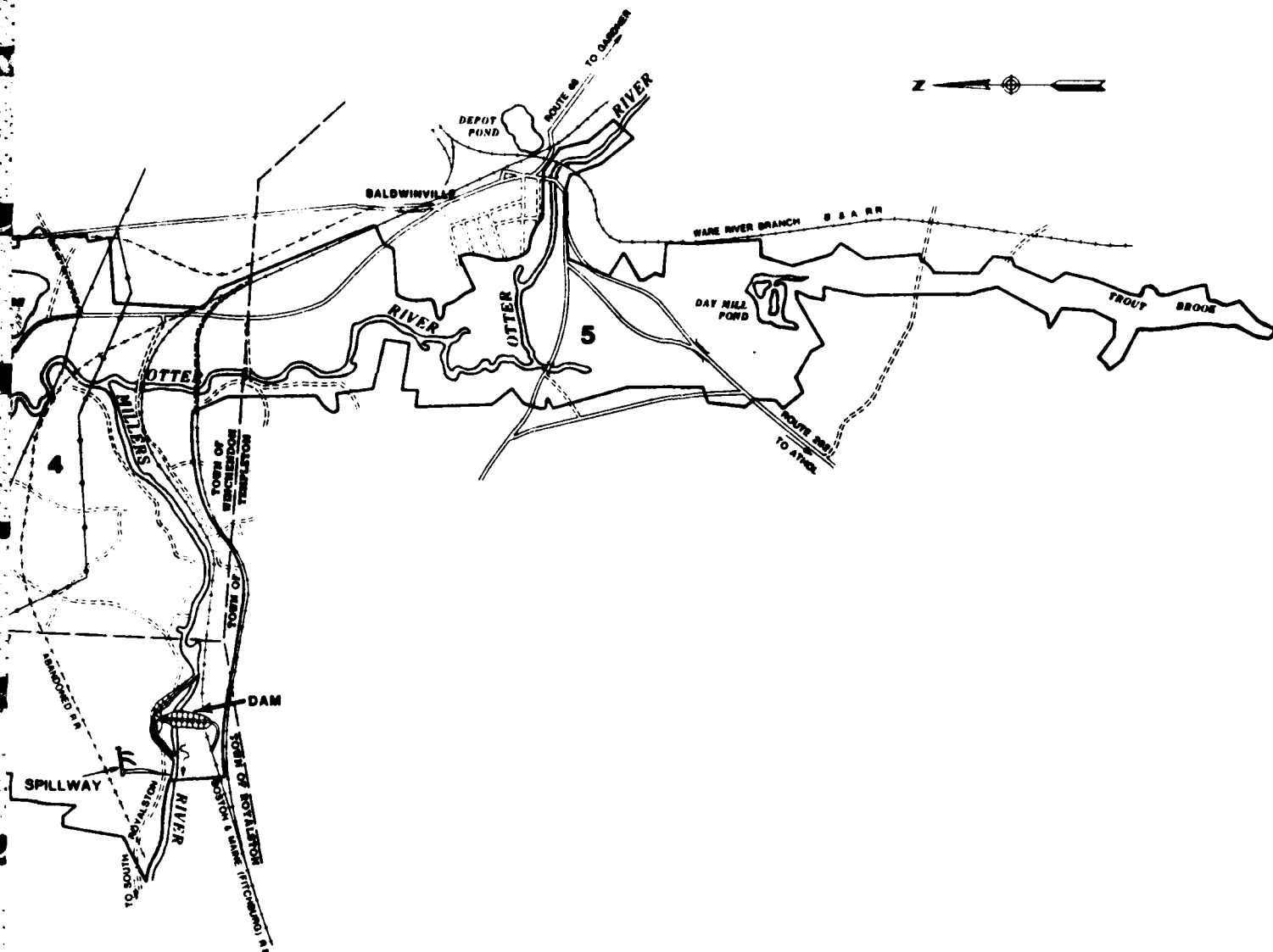
1400 0 1400 2800 4200

2
EXHIBIT B



FOREST COVER
AND COVER
BIRCH HILL

1400 0 1400



**FOREST COMPARTMENTS
AND COVER TYPES OF
BIRCH HILL DAM**

1400 0 1400 2800 4200

LEGEND

- ==== Paved Road
- Gravel Road
- - - - - Compartment Boundary
- _____ Outline of CE Property
- _____ Town Line
- ~~~~~ Water
- ~~~~~ Dam, Dikes

2-83

DTI